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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
STREGE, JOHN B	

ART UNIT	PAPER NUMBER
2625	6

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/809,027	BACHELDER ET AL.	
	Examiner	Art Unit	
	John B Strege	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 March 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 5-9, 13-17, and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burns USPN 5,828,769 in view of Eibert et al. USPN 5,621,807 (hereinafter "Eibert").

Claim 1 discloses, "a method for creating an object model describing the geometry of an object for use in machine vision inspection, said method comprising: acquiring a pixel image representation of an object; generating a set of part models of said object based on said pixel image representation, said part models corresponding to different respective parts of said object, said object model comprising said set of part models; obtaining a test image containing the visual appearance of said object and a given known inspection measurement associated with the test image; performing test inspection on said test image using said object model to produce a testing inspection measurement; and retaining said object model when said given testing inspection measurement deviates from said given known inspection measurement by an amount lower than a predetermined threshold."

Burns discloses a system visual recognition of an object under varations of three-dimensional position (col. 1 lines 16-19). Model images of an object are captured in

digital form (col. 4 line 1) (acquiring a pixel image representation of an object) and multiple image patches are selected from each captured model image (col. 4 lines 2-3)(generating a set of part models). A current image (test image) is captured and patches are selected that contains information useful for determining a pose of the object (col. 4 lines 8-15)(given known inspection measurement associated with the test image). The current image patches are compared with the patches of the model (col. 4 lines 15-18) (performing test inspection on said test image). This is done to decide if the patches are similar (col. 4 lines 16-18). If the corresponding patches are similar a vote is counted(produce a testing inspection measurement), and the votes are used to decide if the current image is similar to the model within a threshold. If so it is then decided that the object has been recognized (col. 5 lines 64-67, continued to col. 6 lines 1-11). Burns does not explicitly disclose retaining the object model if the comparison is found to be sufficiently similar.

It is well known in the art to perform a comparison between a model and an image to determine whether or not to retain the model. Eibert discloses a system for the measurement of objects by means of an intelligent range imaging camera which generates an image of an object in terms of the distance to points on its surface (col. 1 lines 9-12). A plurality of three-dimensional digital models of possible objects is stored in a data processor (col. 1 lines 48-49). Three-dimensional object geometry data acquired by the sensor are compared with one or more of the geometric models in order to identify the object as well as its position and spatial orientation (col. 1 lines 49-54). The geometric model is matched as well as possible with the range image data by a

calculation (col. 3 lines 50-52) (25 figure 2). As seen in figure 2 if the calculation fails another model is selected from the database, and if it is successful the model is retained and classified as a good fit (retaining said object model when said given testing inspection measurement deviates from said given known inspection measurement by an amount lower than a predetermined threshold). Eibert further teaches that the advantages of the invention are that it can be used for zero contact object measurement, position and attitude determination, as well as object classification.

Burns and Eibert are analogous art because they are from the same field of endeavor of image processing comparing images to identify an object.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Burns with Eibert to recognize an object as specified by Burns and retain the model if it is found to be accurate as specified by Eibert. The motivation for doing so would be to classify the model as a good fit for the test image and allow for object measurement, position and attitude determination. Thus it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Burns with Eibert in order to obtain the invention as specified in claim 1.

Regarding claim 5, Eibert discloses determining the measurement, position and attitude of an object.

Regarding claims 6-7, Eibert discloses that to determine the position and location three-dimensional vectors are used. These vectors determine the locations of object surface points in the coordinate system of the sensor (determining a coordinate system

with respect to a specified reference)(col. 4 lines 41-45). The geometric model is then place with respect to the vector coordinate system (col. 4 lines 51-54).

Claim 8 discloses, "the method of claim 1, further comprising: refining one or more of said part models; configuring a machine vision inspection tool based on said object model; evaluating the performance of said object model by evaluating testing inspection measurements in relation to known inspection measurements to produce an indication that said object model is one of satisfactory and unsatisfactory; determining when said evaluating produces an indication of unsatisfactory, one or more causes that caused the unsatisfactory indication; and deciding an act to which to return for an iteration based on said cause, said act including said generating, said creating, said refining, and said configuring."

As discussed above the combination of Burns and Eibert discloses all of the limitations of claim 1. Burns teaches that it would be useful to use an iterative match refinement technique for improving a model after recognizing it (col. 3 lines 18-23)(refining one or more part models and deciding an act to which to return for an iteration based on said cause, said act including said generating, said creating, said refining, and said configuring).Eibert discloses configuring a computer to carry out machine vision inspection on an object(col. 3 lines 11-14)(configuring a machine vision tool based on said object model). As can be seen in figure 2 the performance of the geometric model is evaluated by matching as well as possible with the range image data by a calculation (col. 3 lines 50-52) (25 figure 2). If the model is determined unsatisfactory another model is selected from the database, and if it is successful the

model is retained and classified as a good fit (evaluating the performance of said object model by evaluating testing inspection measurements in relation to known inspection measurements to produce an indication that said object model is one of satisfactory and unsatisfactory). The calculation determines the cause of the unsatisfactory condition.

Claim 9 discloses similar limitations to those discussed in claim 1 with the difference being that the limitations in claim 9 are directed to a system. Thus the same arguments discussed for claim 1 are equally applicable to claim 9.

Claim 13 discloses similar limitations to those discussed in claim 5 with the difference being that the limitations in claim 13 are directed to a system. Thus the same arguments discussed for claim 5 are equally applicable to claim 13.

Claims 14-15 disclose similar limitations to those discussed in claim 6-7 with the difference being that the limitations in claims 14-15 are directed to a system. Thus the same arguments discussed for claims 6-7 are equally applicable to claims 14-15.

Claim 16 discloses similar limitations to those discussed in claim 8 with the difference being that the limitations in claim 16 are directed to a system. Thus the same arguments discussed for claim 8 are equally applicable to claim 16.

Claim 17 discloses similar limitations to those discussed in claim 1 with the difference being that the limitations in claim 17 are directed to a computer readable medium. Thus the same arguments discussed for claim 1 are equally applicable to claim 17.

Claim 21 discloses similar limitations to those discussed in claim 5 with the difference being that the limitations in claim 21 are directed to a computer readable

medium. Thus the same arguments discussed for claim 5 are equally applicable to claim 21.

Claims 22-23 disclose similar limitations to those discussed in claims 6-7 with the difference being that the limitations in claim 22-23 are directed to a computer readable medium. Thus the same arguments discussed for claim 6-7 are equally applicable to claims 22-23.

Claim 24 discloses similar limitations to those discussed in claim 8 with the difference being that the limitations in claim 24 are directed to a computer readable medium. Thus the same arguments discussed for claim 1 are equally applicable to claim 24.

3. Claims 2-4, 10-12, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burns USPN 5,828,769 in view of Eibert et al. USPN 5,621,807 (hereinafter "Eibert") and further in view of Shum et al. USPN 6,084,592 (hereinafter "Shum").

Claim 2 discloses, "the method of claim 1, further comprising: calibrating an image acquisition system to enable said acquiring to obtain calibrated said pixel image representation of said object; and specifying one or more constraints for said object prior to said generating to provide additional information constraining said generating."

As discussed above the combination of Burns and Eibert disclose all of the limitations of claim 1. Eibert further discloses calibrating the intelligent camera used for object measurement in order to eliminate systematic distance measurement errors (col. 2 lines 56-63).

The combination of Burns and Eibert does not explicitly disclose specifying constraints for said object prior to said generating to provide additional constraining information.

Shum discloses a method for the construction of three-dimensional models based on information or constraints provided (col. 1 lines7-13, and col. 2 lines 30-31). Shum teaches that previous systems did not exploit important regularities present in the environment (col. 2 lines 32-34). Shum further discloses, "the structures associated with the manmade environment are full of regularities such as parallel lines...etc., which can be taken advantage of in the modeling process. Using these constraints, a fairly complex 3D model can be constructed" (col. 2 lines 34-40). It should further be noted that Shum discloses, "the system and process of the present invention could also handle calibrated images as well" (col. 2 lines 22-23).

Burns, Eibert, and Shum are all analogous art because they are all from the same field of endeavor of image processing using models.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Burns and Eibert to calibrate an image acquisition system. The motivation for doing so would be to allow for accurate measurements as is well known in the art. Furthermore it would have been obvious to further combine Shum to specify various constraints in order to take advantage of the regularities of the object in the modeling process. Thus it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Burns, Eibert, and Shum to obtain the invention as specified in claim 2.

Regarding claims 3 and 4, Shum discloses that the system employs all available geometric constraints and includes points, plane normals, line directions, plane distances, and parallel plane designations.

Claim 10 discloses similar limitations to those discussed in claim 2 with the difference being that the limitations in claim 10 are directed to a system. Thus the same arguments discussed for claim 2 are equally applicable to claim 10.

Claims 11-12 disclose similar limitations to those discussed in claims 3-4 with the difference being that the limitations in claim 11-12 are directed to a system. Thus the same arguments discussed for claims 3-4 are equally applicable to claims 11-12.

Claim 18 discloses similar limitations to those discussed in claim 2 with the difference being that the limitations in claim 18 are directed to a computer readable medium. Thus the same arguments discussed for claim 2 are equally applicable to claim 18.

Claims 19-20 disclose similar limitations to those discussed in claim 3-4 with the difference being that the limitations in claims 19-20 are directed to a computer readable medium. Thus the same arguments discussed for claims 3-4 are equally applicable to claims 19-20.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B Strege whose telephone number is (703) 305-8679. The examiner can normally be reached Monday-Friday between the hours of 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JS

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